

Appl. No. 10/577,652
Amendment dated October 31, 2010
Reply to Office Action of August 4, 2010

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REMARKS/ARGUMENTS

Claims 1-25 are pending in the application, have been examined, and now stand rejected by the Examiner. By way of the present amendment, claims 1, 3-7, 9, 10, 15, 19, 20 and 24 have been amended. Claims 2, 8, 12-14 and 22 have been cancelled. Claims 26-28 have been added. Applicant requests entry of this amendment and reconsideration of the claims.

Claim Rejections - 35 USC §112

Prior claims 1, 5, 6, 8, 10, 15, 19 and 24 were rejected under 35 USC §112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 5, 10, 15, 19 and 24, the Examiner stated that it was allegedly unclear how the predetermined fluence and the input fluence are related. These claims have been amended to recite "a radiation source (16) for inputting a beam of said radiation having an input energy fluence".

Regarding Claims 5, 6, 8 and 10, the Examiner stated that it was unclear how any of them necessarily modify the structure of the invention; and thus it was unclear how they modify the scope of the invention.

Applicants have amended claims 5 to recite "The apparatus according to claim 3, said apparatus being configured such that said energy fluence of said redirected radiation is less than or equal to said input energy fluence".

The applicant submits that this recitation now provides the claim with a structural limitation. Similar amendments have been made to claims 6, and 10.

Claim 8 was canceled.

Accordingly Applicant submits that the amended claims do comply with § 112 second paragraph and therefore requests withdrawal of this objection.

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Claim Rejections - 35 USC §103

Prior claims 1-25 were rejected under 35 USC §103(a) as allegedly unpatentable over Altshuler (20060058712) in view of Koziol (5425727) and Nagase et al (20020022829).

Applicant has amended independent Claim 1 by reciting "skin" instead of "tissue" and also by reciting an additional element- "first radiation director element comprising a rotator having a rotation axis collinear with the symmetry axis".

Amended independent Claim 1 also further recites a "second radiation directing element (25) for redirecting said directed radiation through said surface radially inwards towards said symmetry axis onto said at least one target volume (46) disposed on said symmetry axis beneath said skin surface, such that said radiation is spread out in a rotational path on said surface.

Amended independent Claim 1 is further amended by reciting that "said second radiation directing element (25) has convergence ability in at most, one plane" Support for this amendment is to be found in Figs. 2B, 3A, 25C, 3D, 3F, 3G and through the specifications as originally filed.

Applicant submits that amended independent Claim 1 is novel over Altshuler, Koziol and Nagase, or any combination thereof since as stated, in none of those references the target volume is disposed on symmetry axis beneath said skin surface, such that said radiation is spread out in a rotational path on the surface.

Claim 9 as amended in independent form now recites "reflective beam divider (81) having a symmetry axis (82) for spreading said input radiation in said plurality of directions spaced around said symmetry axis, and a reflective beam collector (83) for redirecting said spread out radiation through said surface radially inwards towards said symmetry axis, onto said at least one target volume (49) disposed on the symmetry axis beneath the skin surface".

Amended independent Claim 9 is further narrowed by reciting that "said reflective beam collector (83) has convergence ability in at most, one plane". Support for this amendment is to be found in Figs. 2B, 3A, 25C, 3D, 3F, 3G and throughout the specifications as originally filed.

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Applicant submits that amended independent claim 9 is novel over Altshuler, Koziol and Nagase, or any combination thereof since, as stated, in none of those references the radiation is spread is "plurality of directions spaced around said symmetry axis" and redirected inwards towards said symmetry axis, onto said at least one target volume (49) disposed on the symmetry axis beneath the skin surface".

Independent Claim 15 has been amended by reciting "skin surface".

Amended claim 15 further recites that "said radiation has convergence controllable independently in the plane parallel to the surface and in the plane perpendicular to the surface". Support for this amendment is to be found in Figs. 3A and 3C and in Paragraph [0113] and [0114].

Applicant submits that amended independent claim 15 is novel over Altshuler, Koziol and Nagase, or any combination thereof since, as stated, none of those references teaches converting said input beam into radiation directed in a plurality of directions spaced around a symmetry axis and inclined angularly to said symmetry axis, towards at least one target volume disposed on said symmetry axis beneath said skin surface.

Particularly regarding claim 16, Examiner suggests that since Koziol teaches that the central reflectors (12a-h) are rotated during the irradiation such that the incident radiation is radially spread out, it would have been obvious to also rotate during the method of Altshuler because Altshuler also uses a scanner for forming a pattern in tissue (Paragraph [0258]). Examiner further suggests that it would inherently enable a larger volume of tissue to be irradiated in a smaller amount of time. Applicant submits that rotating during Altshuler's method would be contrary to the goal of the Altshuler invention, which is for creating multiple discrete islets surrounded by non treated tissue. The rotation would produce continuous incisions similar to those created by Koziol's method. Therefore, the applicant submits that combination of Altshuler and Koziol to render claim 16 as obvious is improper.

New dependent claim 26 recites a conversion system that converges the radiation without the use of elements having optical power. New dependent claim 27 recites a second radiation directing element that use no optical power for converging the radiation. New dependent claim 28 recites a conversion system that converges the radiation without the use elements having optical power. Support for those new claims is to be found in Paragraph [0024] of the specification as published.

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New claims 26 to 28 are dependent variously on independent claims 1 and 9, which the applicant claims as patentable. Therefore, claims 26 to 28 are also deemed patentable.

The References, and the Differences of the Present Claimed Invention Thereover

Following is a discussion of the references and the general novelty in the present claimed invention and its unobviousness over the references.

Altshuler teaches a radiation source that outputs a beam (11) that can be collimated initially (Paragraph [0376]), however, to get a three-dimensional optical islet below the skin surface, the beam must be focused into the skin; while a collimated beam produces islets that include the skin surface (Paragraph [0291]). Applicant's claimed invention does not necessitate focusing the beam into the target and allows using a non focused or collimated beam for targets below the skin surface (Paragraph [0024] of the specifications as originally filed).

The mirrors (62; Figures 32A-32C) or mirrors (62 and 67; Figures 34A and 34B) are utilized with a purpose of creating multiple islets NOT along the symmetry axis or rotation axis but off-center, as noted by the Examiner. In Applicant's claimed invention, target volumes are disposed only on the symmetry axis.

Altshuler also teaches the concept of splitting beam (11) with beam splitter (38; Figures 28-31) for the purpose of creating multiple beams focused into multiple focal points. The splitter 38 divides and then passes through the refracting surfaces 41 and 42 of lens 43 to focus at central point 39 and off-center point 40 (Paragraph [0372]), but are not recombined into a target volume. Altshuler intends to cause damage deep within the skin without causing epidermal damage, but not by reduction of the surface fluence but by active or passive cooling of the epidermis (Paragraph [0195]). Applicant's claimed invention does not require active or passive cooling.

Applicant submits that the novel physical features claimed in Claims 1 as amended are also unobvious and hence patentable since they produce new and unexpected results over Altshuler and Koziol, or any combination thereof. Part of these new and unexpected results is the ability of Applicant's system to prevent epidermal damage without requiring active or passive cooling.

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Koziol teaches an apparatus and method for modifying curvature and refractive power of the cornea by creating incisions of various shapes on either the external surface of the cornea or onto intrastromal area of the cornea. It is known in the art that cornea is a transparent member having a total thickness of 0.5–0.6 mm in the center and 0.6–0.8 mm at the periphery, while the stroma of the cornea is one of the middle layers of the cornea. The stroma is situated approximately 50µm below the surface of the cornea. Therefore it is clear that the light beams illustrated (Figs 2, 13 and 14) are converging towards the surface or very close to the surface but not towards a single volume in the depth of the eye.

The incisions are created in the cornea by focusing the light into multiple line focuses or point focuses spaced symmetrically around the symmetry and rotation axes, but not on the symmetry axis (Figs 6-8, 10-12, 15 and 16). In Applicant's claimed invention, target volumes are disposed on the symmetry axis below the skin.

Moreover, the rotation of Koziol's teaching is aimed at ablating various annular shapes, rather than for reducing the energy fluence on the surface. In Applicant's claimed invention the rotation spreads the energy on the surface for reducing the fluence on the surface.

Both Altshuler's and Koziol's teachings are focusing the energy at multiple targets at predefined locations by splitting the input beam into multiple sub-beams, each of which is focused at a different target. Neither the splitting nor rotation is utilized for spreading the energy on the surface and thereby reducing the fluence on the surface while recombining that energy below the surface.

Nagase teaches concentrating reflected laser beams at the target location within the tissue by moving a mirror along straight line while changing the tilt angle of the mirror to maintain its proper orientation towards the target, thus spreading the energy along a straight line on the tissue surface. Applicant teaches spreading the energy circularly around the symmetry axis, which is different, better and unobvious. Furthermore, no changing the angle of the mirrors is required in Applicant's disclosure.

Examiner suggests that it would have been obvious to use the beam converter of Koziol with the method and device of Altshuler, because it would have enabled the input

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beam to be divided into more sub-beams, which would have further reduced the fluence at the surface. Applicant submits that the proposed combination would not be physically possible or operative because each reference teaches away from each other. Altshuler teaches creation of small islets separated by non-treated tissue, while Koziol teaches producing long continuous incisions. Moreover, even if the combination could be made physically, dividing the input beam into more sub-beams would not reduce the fluence at the surface without reducing the fluence on each target.

The Examiner further suggests that it would have been advantageous to use a device wherein the symmetrical and the rotational axis are collinear with the device of Altshuler because it would have enables the beams to recombine over a greater volume within the tissue, which would have again reduce the total energy at the surface. Applicant submits that Altshuler's device produces multiple islets separated from each other by non-treated tissue (Paragraph [0011]), by splitting the beam into multiple sub beams that are **off-center** (Paragraph [0372]). Therefore, Altshuler teaches away from the concept wherein the symmetrical and the rotational axis are collinear

The Examiner further suggests that it also would have been obvious to use the converter of Koziol with the device/method of Altshuler, because one of Altshuler's goals is to provide methods and devices that cause damage deep within the skin without causing epidermal damage. Koziol's converter splits the input beam into multiple sub-beams and focusing each of those sub-beams into separate point or line, thus creating multiple incisions of desired shapes symmetrically placed around the rotation axis. Applicant submits that without modifications, not taught in the prior art, Koziol's converter would not be effective in preventing the epidermal damage because, as opposed to the cornea which is transparent to light, the epidermis contains chromophores that would absorb the energy and overheat.

The Examiner suggests that it would have been obvious to use the teaching of Nagase to justify using the device of Koziol with the invention of Altshuler, because Altshuler and Nagase are concerned with overheating non-target tissue. Applicant submits that the device of Koziol with the invention of Altshuler does not remove the concern of overheating of non-target tissue because of the reasons stated above. There is no justification in Altshuler, Koziol and Nagase, or in any other prior art separate from applicant's disclosure, which suggests that these references be combined, much less in the manner proposed. However,

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even if the combination could be made, even if combined, Altshuler and Koziol would not meet the claims as amended.

The Examiner states that the device of Koziol provides an alternative device/method to converge light beams to **one point** within the tissue. Applicant submits that Koziol's teaching lacks any suggestion for converging of the beams to one point within the tissue. Furthermore, the fact that those skilled in the art have not implemented this suggestion indicates that it's not obvious.

In summary, the Applicant submits that:

1. There is no justification in Altshuler, Koziol and Nagase, or in any other prior art separate from applicant's disclosure, which suggests that these references be combined, much less in the manner proposed.
2. The proposed combination would not be physically possible or operative because each reference teaches away from each other.
3. Even if Altshuler and Koziol were to be combined in the manner proposed, the proposed combination would not show all of the novel physical features of the Claims as amended.
4. These novel physical features of the Claims as amended produce new and unexpected results and hence are unobvious and patentable over these references.

Conclusion

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Respectfully submitted

Alex Rapoport
Applicant